

In the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. - 22. (Canceled)

23. (Currently Amended) A quick-action clamping cylinder comprising
a housing (1) and a cover (2) covering the housing, the cover (2) having a center opening (32) for receiving a retractable nipple (3) arranged on the lower side of a workpiece pallet (68),
a plurality of locking balls (21) providing a spring-loaded lock for the retractable nipple in the housing, wherein the locking balls (21) are in locked position in spring-loaded contact with the outer periphery of the retractable nipple (3) and move into unlocked position by disengaging from the retractable nipple through movement of a piston (4) operated by pressure means,
springs (7) contact a spring support surface (35) of a tubular ring shape projection (104) of the piston (4), along its inner periphery the tubular ring shape projection (104) of the piston (4) defining a first chamfer (25) having a slope less than approximately 7 degrees in a radial inward direction on which the locking balls (21) contact at a first position (24) when in the locked position; when in the locked position, the locking balls (21) contact the outer periphery of the retractable nipple (3) at a second position (23) and contact the lower side of the cover (2) at a third position (22),
wherein the locking balls (21) convert transfer the spring force exerted by the springs (7) through a transmission ratio of a lever arm into a multiple of the retraction force applied to the retractable nipple (3), and wherein the piston (4) has a chamfer (25) with a slope smaller than an automatic locking threshold to the tubular ring shaped projection (104) of the piston (4) at the first position (24) along the first chamfer (25); the spring force, in turn, being transferred at the first position (24) of the piston (4) via a first lever arm (102) to the third position (22) along the bottom periphery of the cover (2) while also forming a second lever arm (103) that terminates along the outer periphery of the retractable nipple (3) with the locking balls (21) supported at the second position (23); the locking balls (21) forming a lever (29) resulting from the first lever arm (102) and the second lever arm (103) so as to transfer the spring force of the springs (7) at the

first position (24) with a predetermined transmission ratio to the second position (23) on the outer periphery of the retractable nipple (3);

wherein the third ball position (22) being defined along a third chamfer (28) on the outer periphery of the retractable nipple (3) having a slope in the radial outward direction opposite that of the first chamfer (25).

24. (Canceled) .

25. (Withdrawn) The quick-action clamping cylinder according to claim 23, wherein the piston (4) is displaceably and sealingly guided between the surfaces of the cover (2) and of the housing (1).

26. (Withdrawn) The quick-action clamping cylinder according to claim 23, wherein the part of the piston (4) contacted by the locking balls (21) is formed as a bendable ring-shaped projection (104).

27. (Withdrawn) The quick-action clamping cylinder according to claim 23, wherein the outside of the piston (4) includes sealing rings which sealingly contact an unsupported cover projection (105) of the cover (2).

28. (Withdrawn) The quick-action clamping cylinder according to claim 23, wherein each spring (7) contacts with a radial outward section a radially outwardly oriented, upper spring support surface (35) on the bottom side of the piston (4) and a radially outwardly oriented lower spring support surface (36) of the spring support (6).

29. (Withdrawn) The quick-action clamping cylinder according to claim 28, wherein the outwardly oriented, upper spring support (35) is approximately aligned below a cylinder space (12), so that the cylinder space (12) is not deformed when the locking engagement is released.

30. (Withdrawn) The quick-action clamping cylinder according to claim 28, wherein the lower

spring support (6) and hence the entire locking device is fitted and held in the tubular housing (1) of the clamping system by locking balls (8), which are uniformly distributed along the periphery.

31. (Withdrawn) The quick-action clamping cylinder according to claim 23, wherein a cylinder space (12) having a small volume is provided by an opposing arrangement of a cover projection (105) in the cover (2) and an offset in the piston (4).

32. (Withdrawn) The quick-action clamping cylinder according to claim 23, wherein the cylinder space (12) is arranged radially outwardly in the tubular housing (1), so that the screws (19) absorb deformation forces to which the cover (2) may be subjected.

33. (Withdrawn) The quick-action clamping cylinder according to claim 32, wherein the transition region in the cover (2) between the downwardly extended cover projection (105) for guiding the piston (4) and the region of the cover (2) through which the screws (19) extend, is formed so as to be capable of transmitting a large load and protected against deformations.

34. (Withdrawn) The quick-action clamping cylinder according to claim 32, wherein the cover (2) has a diminishing material thickness in the region that extends radially inwardly as viewed from the extended cover projection (105).

35. (Withdrawn) The quick-action clamping cylinder according to claim 23, wherein on the piston (4), a chamfer (25) with the small slope is followed in the axial direction by a chamfer (26) with a greater slope.

36. (Withdrawn) The quick-action clamping cylinder according to claim 23, wherein a conical tip of the retractable nipple (3) engages with the center interior space (30) in the clamping cylinder, where it centers in an opposing conical recess.

37. (Withdrawn) The quick-action clamping cylinder according to claim 23, wherein the blow-off air is supplied to a tubular housing (1) via an air connection (44), from where it reaches via an

ascending vertical bore the lower region of the tubular housing (1), where the air enters a circumferential recess (9).

38. (Withdrawn) The quick-action clamping cylinder according to claim 37, wherein the blow-off air flows between the bottom side of a spring support (6) and the inside of the cover (42) through a gap (43) extending approximately over the entire diameter of the bottom side of the housing, and branches to the outside region of the clamping system by way of a first air pathway through the recess (9) arranged along the outer periphery, and to the center interior region of the clamping system by way of a second air pathway.

39. (Withdrawn) The quick-action clamping system with a quick-action clamping cylinder according to claim 37, wherein the blow-off air produces an air flow directed at an angle against the bottom side of the locking balls (21), with the air flow rotatably driving the locking balls, causing them to circulate in the peripheral direction about the retractable nipple.

40. (Withdrawn) The quick-action clamping system with a quick-action clamping cylinder according to claim 23, wherein the retractable nipple (3) is connected with a catch screw (56), which cooperates with a catch device disposed on a reciprocating piston (87) of the clamping system, wherein the catch device catches the retractable nipple exiting the opening in the clamping system and retracts the retractable nipple into the clamping system.

41. (Withdrawn) The quick-action clamping system with a quick-action clamping cylinder according to claim 23, wherein the ball support (5) and the spring support (6) are connected with each other, forming a built-in module (57, 58, 59) which clamps the springs (7).

42. (Withdrawn) The quick-action clamping system with a quick-action clamping cylinder according to claim 23, wherein the quick-action clamping system is mounted in a machine table as a built-in module (80) configured as a built-in cartridge.

43. (Withdrawn) The quick-action clamping system with a quick-action clamping cylinder

according to claim 42, wherein the lower spring support (6) is connected with a cylindrical tube (74) made of the same material (as a single piece) to form the cylinder for guiding the piston (4).

44. (Canceled)

45. (Withdrawn) The quick-action clamping cylinder according to claim 32, wherein the cylinder space (12) arrangement is proximate of the radially outwardly arranged screws (19) between the cover (2) and the tubular housing (1), so that the screws (19) absorb deformation forces to which the cover (2) may be subjected.

46. (Withdrawn) The quick-action clamping system with a quick-action clamping cylinder according to claim 38, wherein the blow-off air produces an air flow directed at an angle against the bottom side of the locking balls (21), with the air flow rotatably driving the locking balls, causing them to circulate in the peripheral direction about the retractable nipple.

47. (New) The quick-action clamping cylinder according to claim 23, wherein the tubular ring shape projection (104) of the piston (4) defines a second chamfer (26) along which the locking balls (21) contact when in the unlocked position, the second chamfer (26) having a slope greater than that of the first chamfer (25).

48. (New) The quick-action clamping cylinder according to claim 23, wherein the locking balls (21) are elastically deformable.